

## Group I — The Alkali Metals

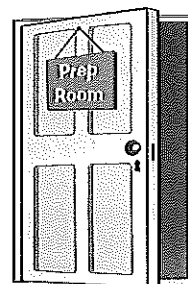
**Q1** Group 1 of the Periodic Table is known as the Alkali Metals.

- Why is Group I of the Periodic Table known as the Alkali Metals?
- Why are they known as "Group I" in the Periodic Table?

**Q2** How are the Alkali metals stored and why are they stored this way?

**Q3** Alkali metals react with water to produce a gas and a solution.

- What colour would the resulting solution be if universal indicator was added?
- What would be the pH of the resulting solution?



**Q4** The table on the right shows four alkali metals and some of their physical properties.

Alkali Metal	Atomic Mass	Symbol	Boiling Point °C	Melting Point °C	Density g/cm <sup>3</sup>
Lithium	7		1342	181	0.535
Sodium	23		880	98	0.971
Potassium	39		760	63	0.862
Rubidium	85.5		688	39	1.53

- Complete the table by filling in their symbols.
- Caesium is the next alkali metal. Estimate its: i) Boiling point ii) Melting point iii) Density.
- Explain why, as you go down Group I, the atoms get bigger in cross-section.
- Which member of the group in the table is the most dense?
- What must become weaker for the melting point to decrease down the group?
- Over what temperatures ranges would you expect i) Rubidium, ii) Potassium, to be liquids?

**Q5** Explain why a freshly cut piece of sodium would have a shiny surface, but after a while it would turn white.



**Q6** Complete the table below, then answer the following questions:

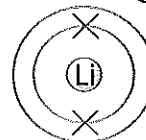
Alkali Metal	No. of Protons	No. of Neutrons	No. of Electrons	Atomic Number	Mass Number
Lithium				3	7
Sodium	11				23
Potassium	19	20			
Rubidium				37	85
Caesium	55				133

- Draw an atom of sodium showing its electron arrangement.
- How many electrons has sodium in its outer shell?
- Why does this make sodium so reactive?
- What has to happen to an atom of sodium for it to achieve a full outer shell?
- What is the charge of a sodium ion? Explain your answer.
- When sodium bonds, it changes from an atom to an ion. What is meant by the term "ion"?

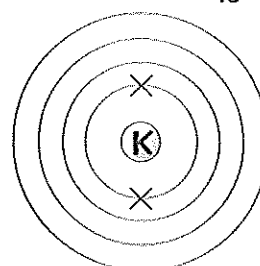
**Q7** Shown below are two diagrams of atoms.

- Complete the atoms by adding the correct number of electrons in each shell.
- How can lithium and potassium gain a full outer shell of electrons?
- What would the charge on the ions be?
- Write the symbol for each ion formed.
- In general, the further away the outer electron from the nucleus, the easier it is to remove. Which of lithium and potassium would you expect to be more reactive? Explain your answer.

Lithium  ${}^7_3\text{Li}$



Potassium  ${}^{39}_{19}\text{K}$



## Group 1 — The Alkali Metals

- Q8** Put the metals in the box in order of reactivity — the most reactive first.

*Caesium, Potassium, Lithium,  
Sodium, Rubidium.*

- Q9** Match up the alkali metal to its reaction in water:

<b>A) Potassium</b>
<b>B) Sodium</b>
<b>C) Lithium</b>

<b>1) Ignites with yellow/orange flame, fizzes vigorously.</b>
<b>2) No flame, but fizzes.</b>
<b>3) Pops and ignites with a lilac flame, fizzes very vigorously.</b>

- Q10** When an alkali metal reacts with water, a gas is produced.

a) Name the gas that is produced.

**Sodium + Water** →

b) How could you test for this gas?

**Lithium + Water** →

c) Complete the equations to the right.

d) i) Complete and balance this equation:  $K_{(s)} + H_2O_{(l)} \rightarrow KOH_{(aq)} +$    
 ii) What do the symbols (s), (l), (aq), and (g) stand for in chemical equations?

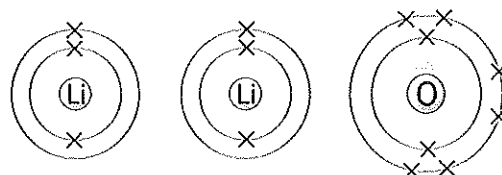
- Q11** Name two ions present in an aqueous solution of potassium hydroxide.

- Q12** Lithium burns in air to form lithium oxide.

a) i) Using the diagrams, explain how this happens.

ii) Write the formula of the compound lithium oxide.

iii) Complete the equations below and balance them:



**Lithium + oxygen** →

**Sodium + oxygen** →

**Li + O<sub>2</sub>** →

**Na + O<sub>2</sub>** →

- b) All the alkali metals in Group 1 would react in a similar way with oxygen and water. Explain why this is so.

- Q13** Complete the table below with the given words and sentences.

tarnishes quickly to give an oxide layer

tarnishes slowly to give oxide layer

tarnishes very quickly to give oxide layer

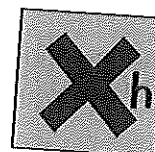
	Reaction of the Metal in Air
<b>Lithium</b>	
<b>Sodium</b>	
<b>Potassium</b>	

- Q14** Rubidium and caesium are very dangerous.

a) Predict how these react with water.

b) Predict how these react with air.

c) Why are these two metals so reactive?



### Top Tips:

With only one electron in their outer shell, these metals don't have much to lose — they're pretty reactive. The Exam's most likely to ask about trends in the group — make sure you know how size, reactivity, density and melting and boiling points vary down the group — and why.